

Size matters: be wary of characterizing aerosol composition and type with pseudo-intrinsic parameters

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There have been many efforts to characterize aerosols by composition or by type. Aerosol type generally refers to the classification of a group of particles by source (marine, urban, dust, smoke, etc.), whereas aerosol composition refers to the retrieval of one or more species within an aerosol mixture (e.g., black carbon, brown carbon, water content). Both schemes utilize intrinsic and pseudo-intrinsic aerosol parameters. Intrinsic aerosol parameters (like refractive index) do not depend upon the mass of a collection of particles. However, some aerosol parameters that do not depend upon aerosol mass are still sensitive to particle size; we label these parameters as “pseudo-intrinsic.” Examples of pseudo-intrinsic aerosol parameters include single-scatter albedo, fine volume fraction, fine mode fraction, Ångström exponent, backscatter Ångström exponent, backscatter color ratio, lidar ratio, and absorption Ångström exponent (AAE).

The “typing” of aerosols with pseudo-intrinsic aerosol parameters can mask size-dependent effects and lead to ambiguous results (if one does not monitor particle size with another parameter). This has been a shortcoming in some recent papers that utilize AAE in an attempt to separate carbonaceous absorption aerosol optical depth (AAOD) from dust AAOD without considering aerosol size. Thus, we demonstrate that one can not separate carbonaceous aerosols from dust on the basis of AAE alone. We also review past work for retrieving black carbon and aerosol water fractions with the aerosol complex refractive index (Schuster et al., *GRL* 2009; *ACP* 2016), and provide a new method for obtaining black carbon AAOD.

Mode of presentation: Invited